T06T0T' 6282E00T

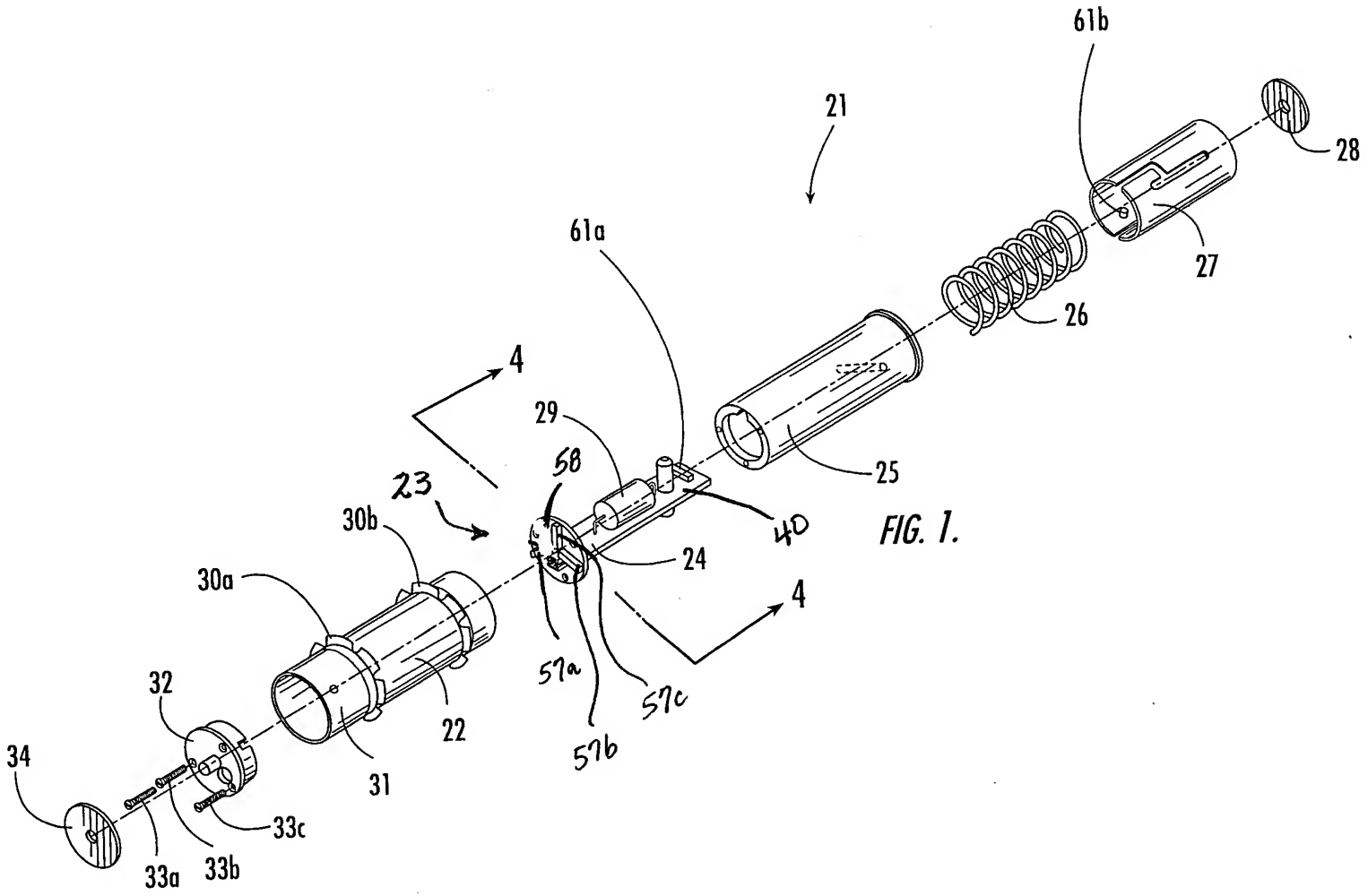

FIG. 1.

T06T0T"628280T

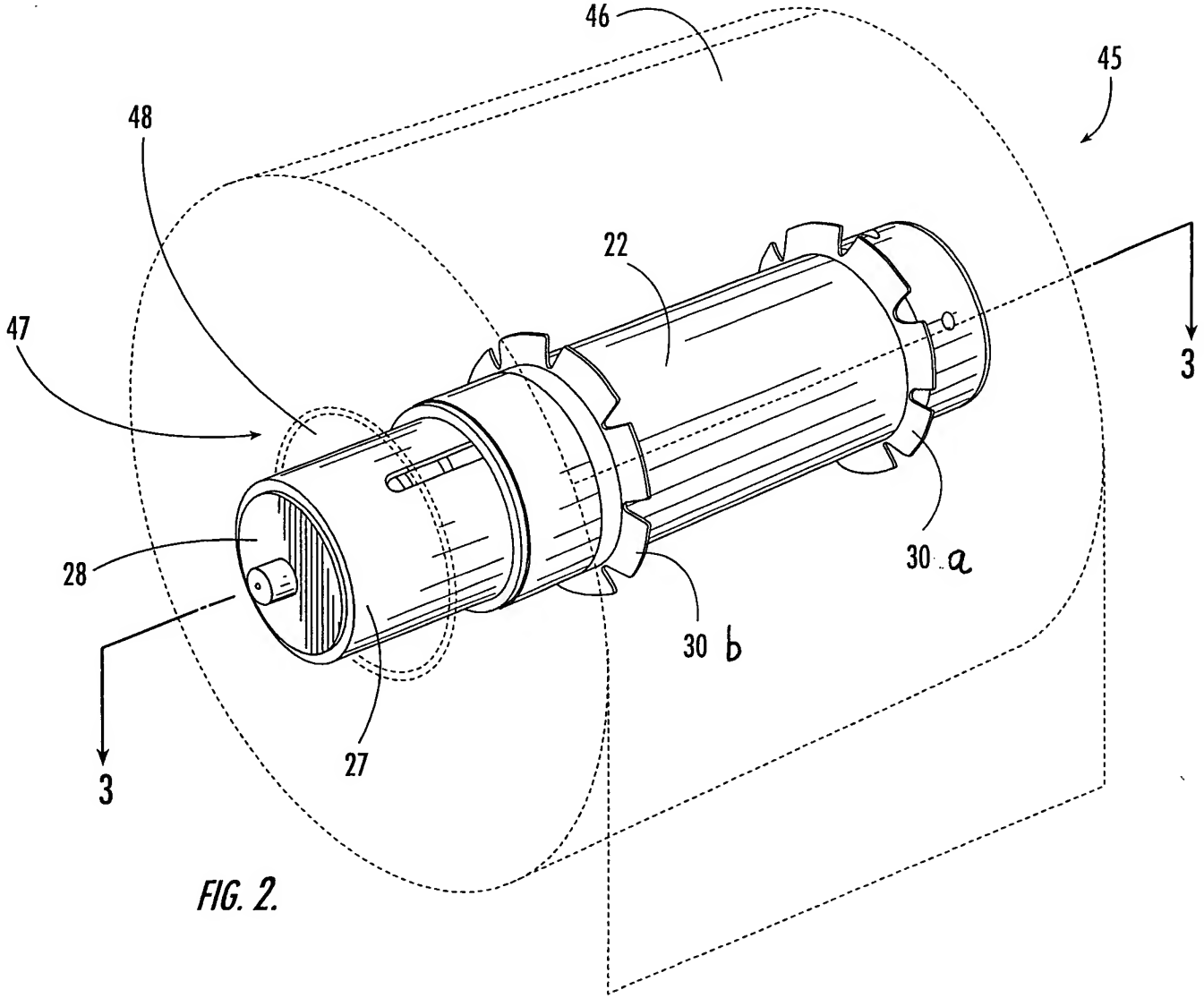

FIG. 2.

T06T0T" 6282E00T

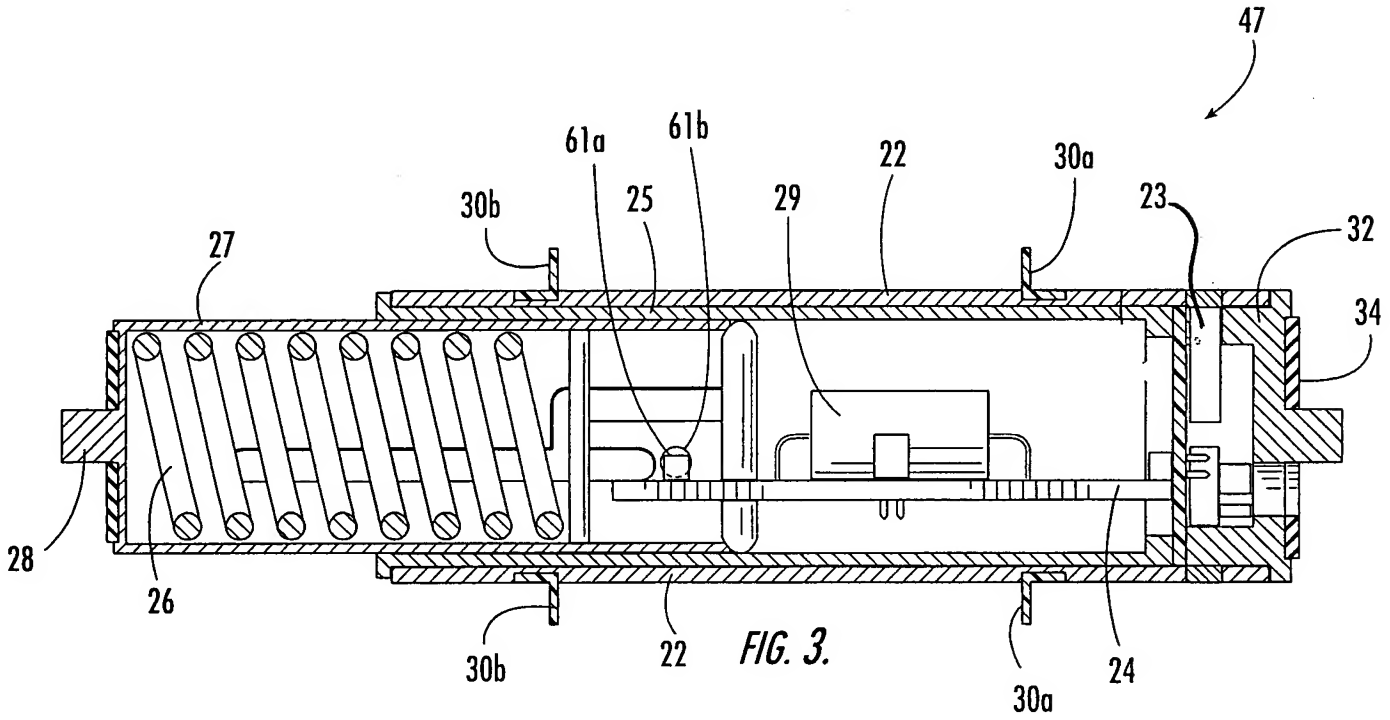

FIG. 3.

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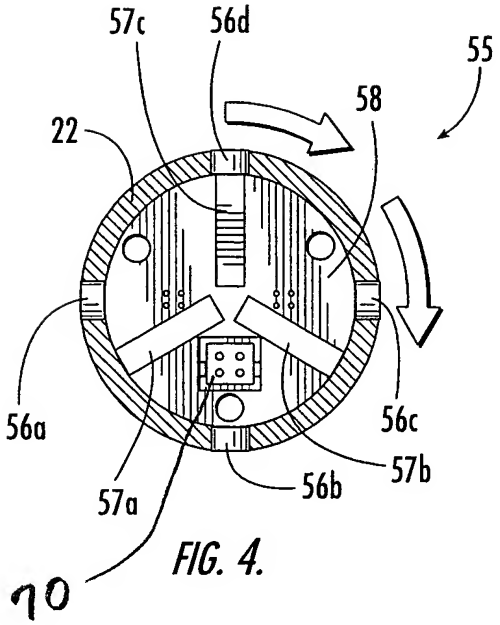


FIG. 4.

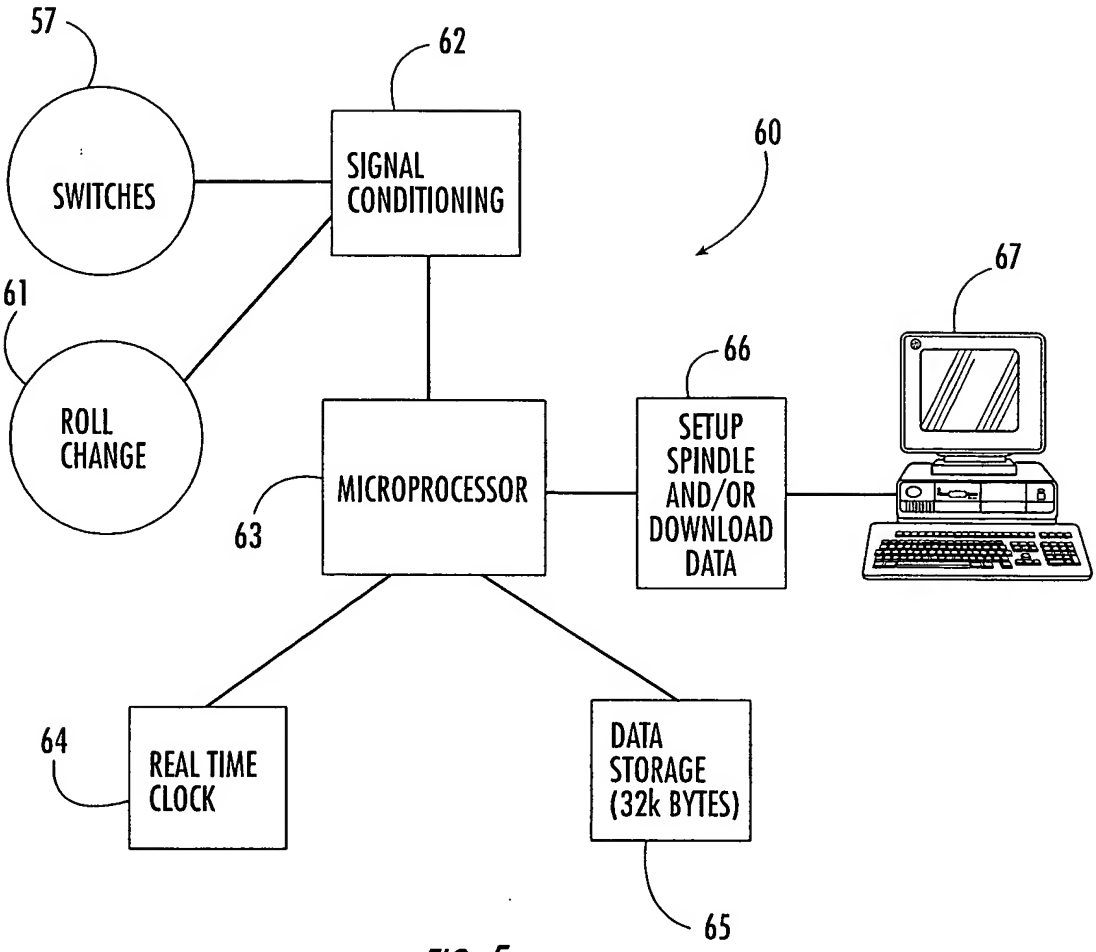

57
62
SWITCHES
SIGNAL CONDITIONING
60
61
67
66
ROLL CHANGE
MICROPROCESSOR
SETUP SPINDLE AND/OR DOWNLOAD DATA
63
64
REAL TIME CLOCK
DATA STORAGE (32k BYTES)
65

FIG. 5.

FIG. 6A

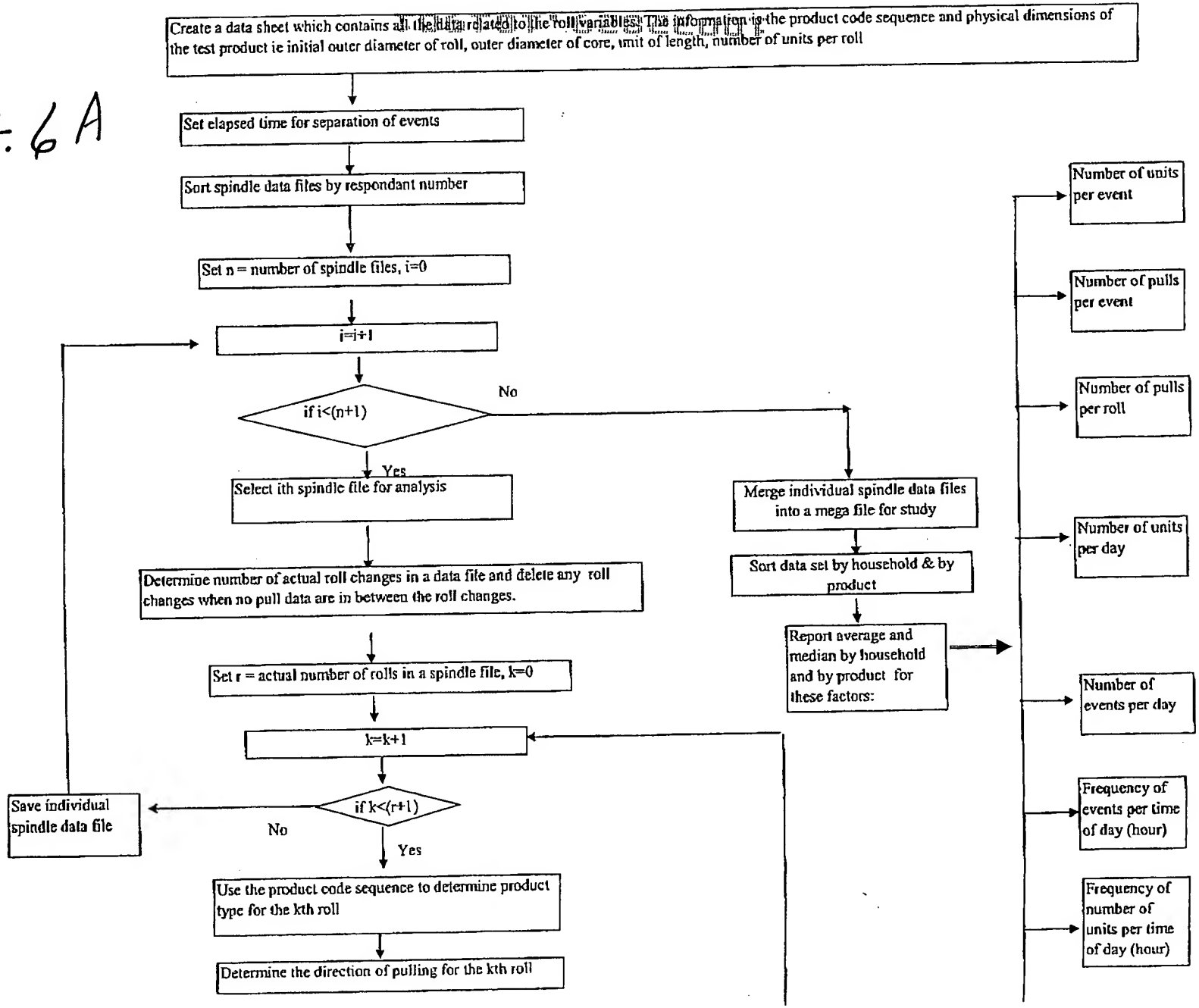
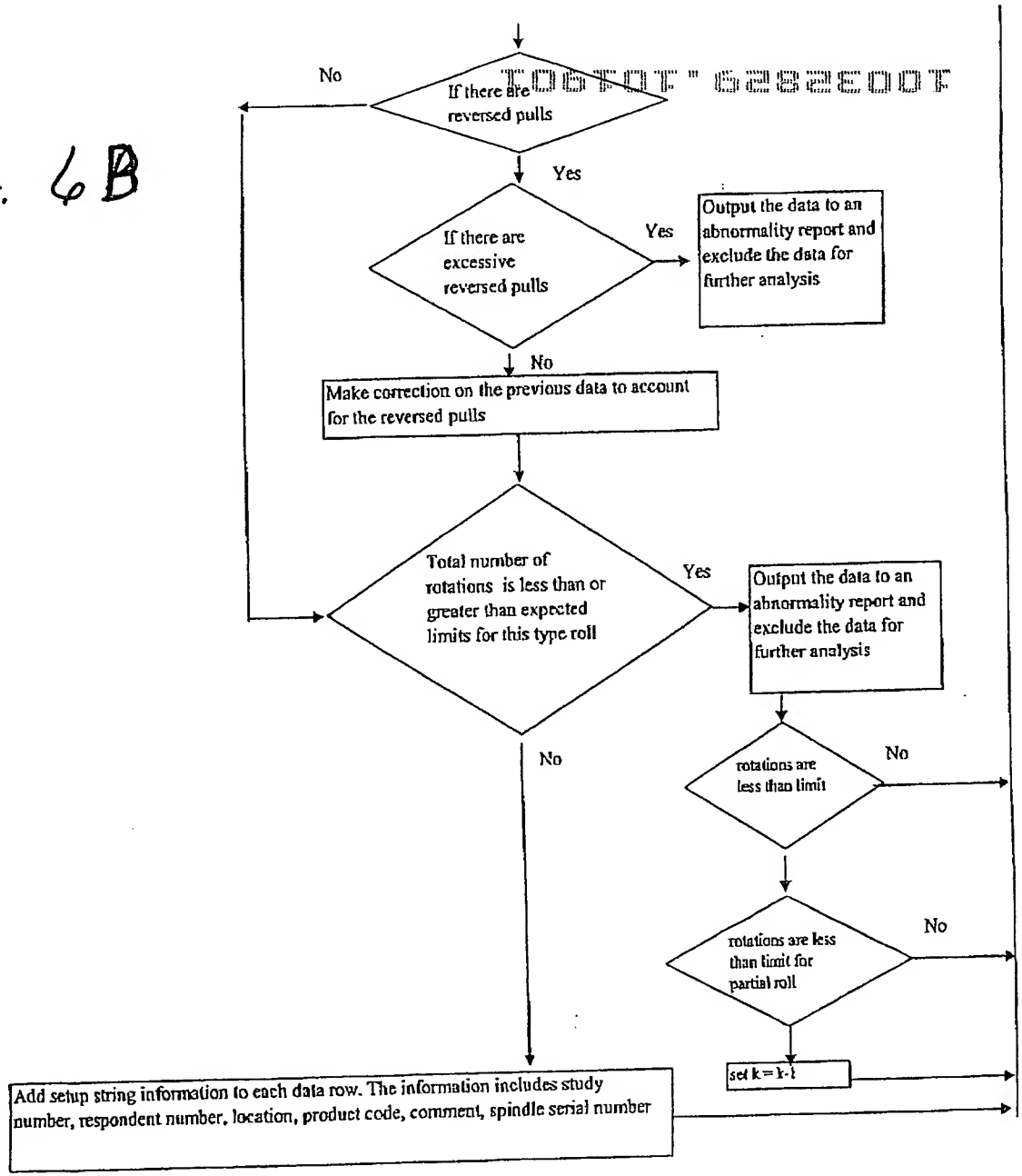
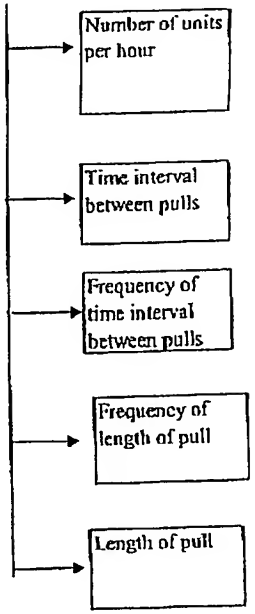

Create a data sheet which contains all the data related to the roll variables. The information is the product code sequence and physical dimensions of the test product ie initial outer diameter of roll, outer diameter of core, unit of length, number of units per roll
Set elapsed time for separation of events
Sort spindle data files by respondant number
Set n = number of spindle files, i=0
i=i+1
if i<(n+1)
No
Yes
Select ith spindle file for analysis
Determine number of actual roll changes in a data file and delete any roll changes when no pull data are in between the roll changes.
Set r = actual number of rolls in a spindle file, k=0
k=k+1
if k<(r+1)
No
Yes
Save individual spindle data file
Use the product code sequence to determine product type for the kth roll
Determine the direction of pulling for the kth roll
Merge individual spindle data files into a mega file for study
Sort data set by household & by product
Report average and median by household and by product for these factors:
Number of units per event
Number of pulls per event
Number of pulls per roll
Number of units per day
Number of events per day
Frequency of events per time of day (hour)
Frequency of number of units per time of day (hour)

FIG. 6B


If there are reversed pulls
No
Yes
If there are excessive reversed pulls
Yes
Output the data to an abnormality report and exclude the data for further analysis
No
Make correction on the previous data to account for the reversed pulls
Total number of rotations is less than or greater than expected limits for this type roll
Yes
Outpnt the data to an abnormality report and exclude the data for further analysis
No
rotations are less than limit
No
rotations are less than limit for partial roll
No
set k = k-1
Add setup string information to each data row. The information includes study number, respondent number, location, product code, comment, spindle serial number


Number of units per hour
Time interval between pulls
Frequency of time interval between pulls
Frequency of length of pull
Length of pull

Use of Smart Spindle for toilet paper utility in Consumer Home

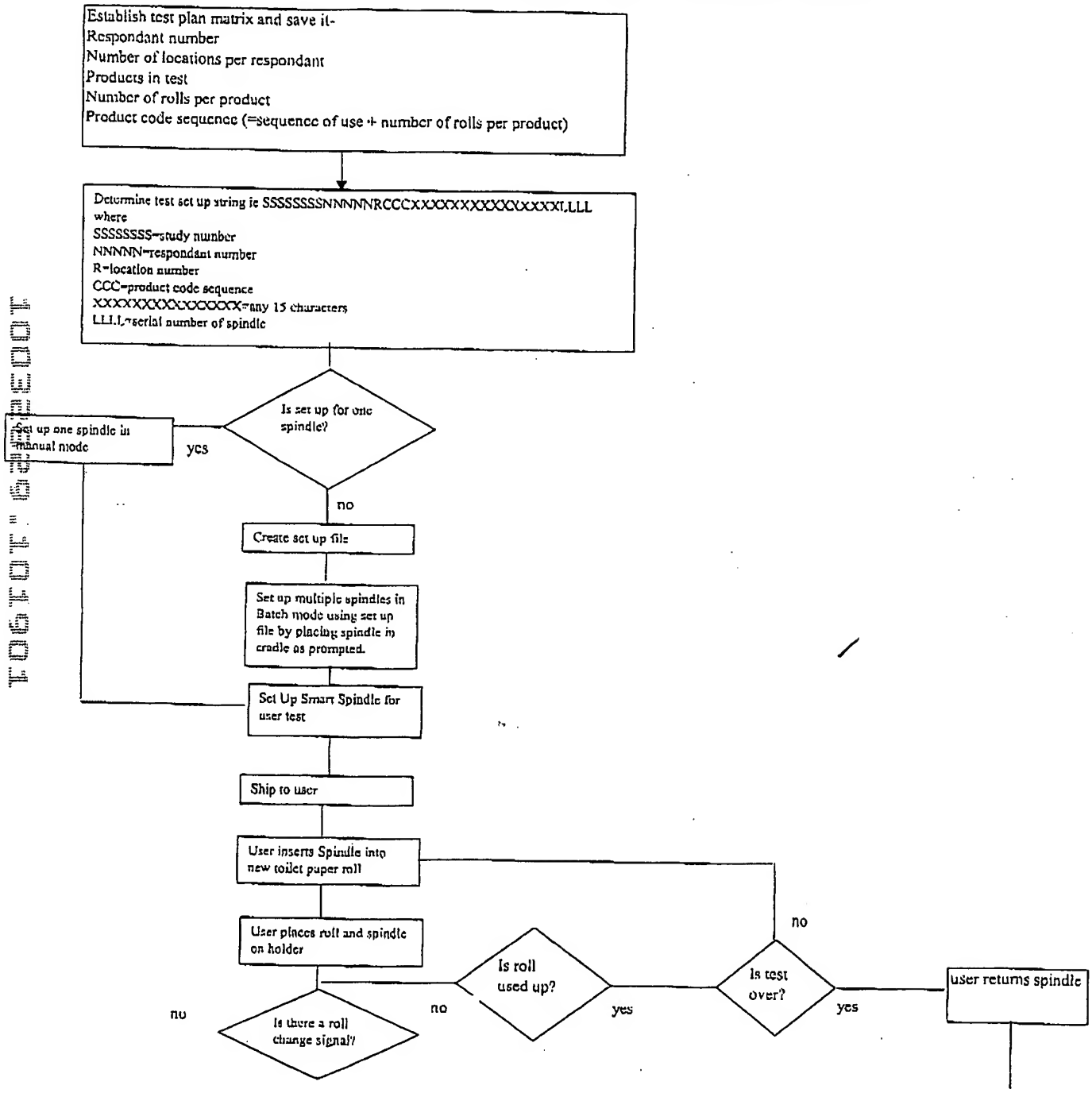


FIG 7A

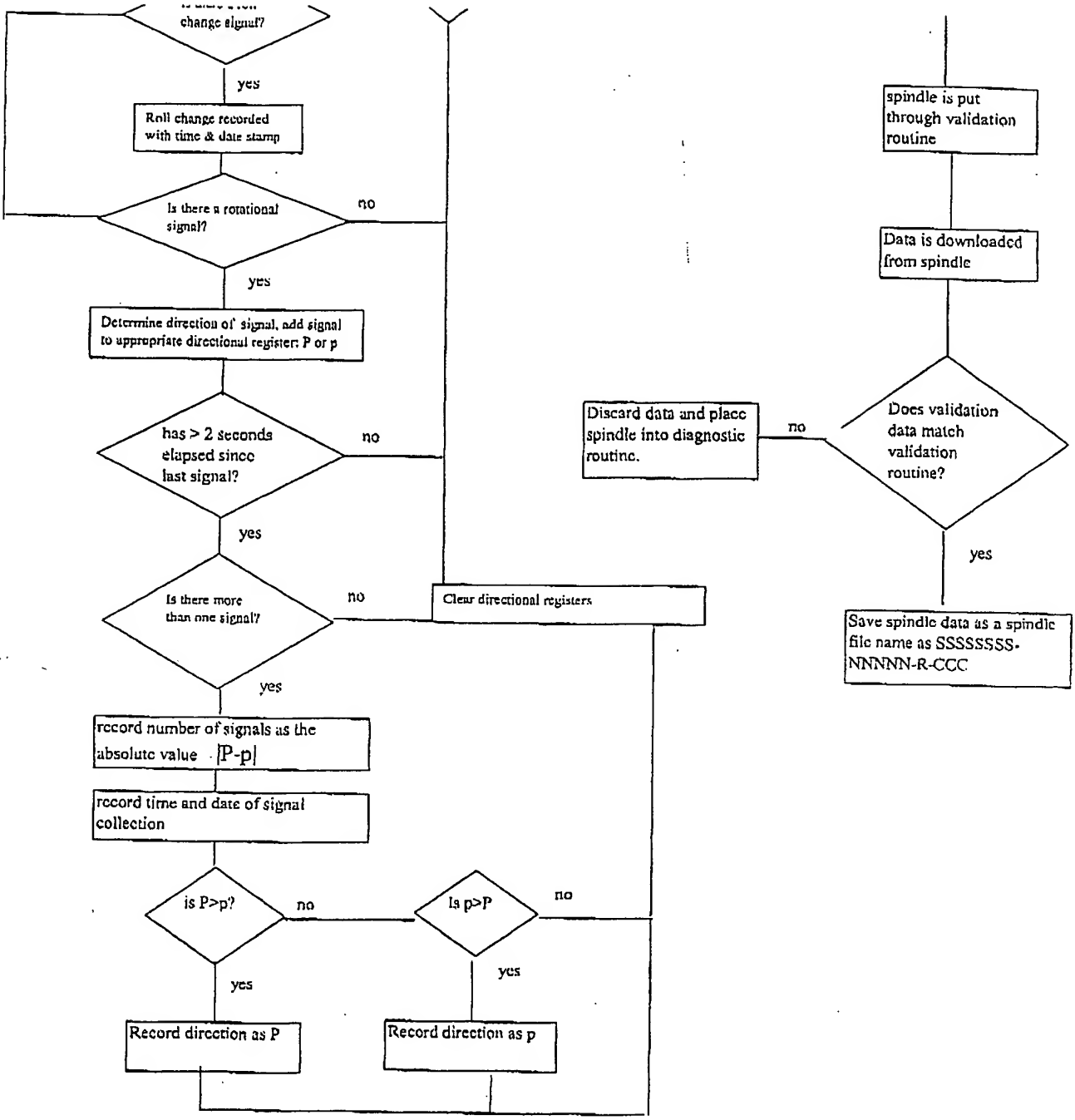
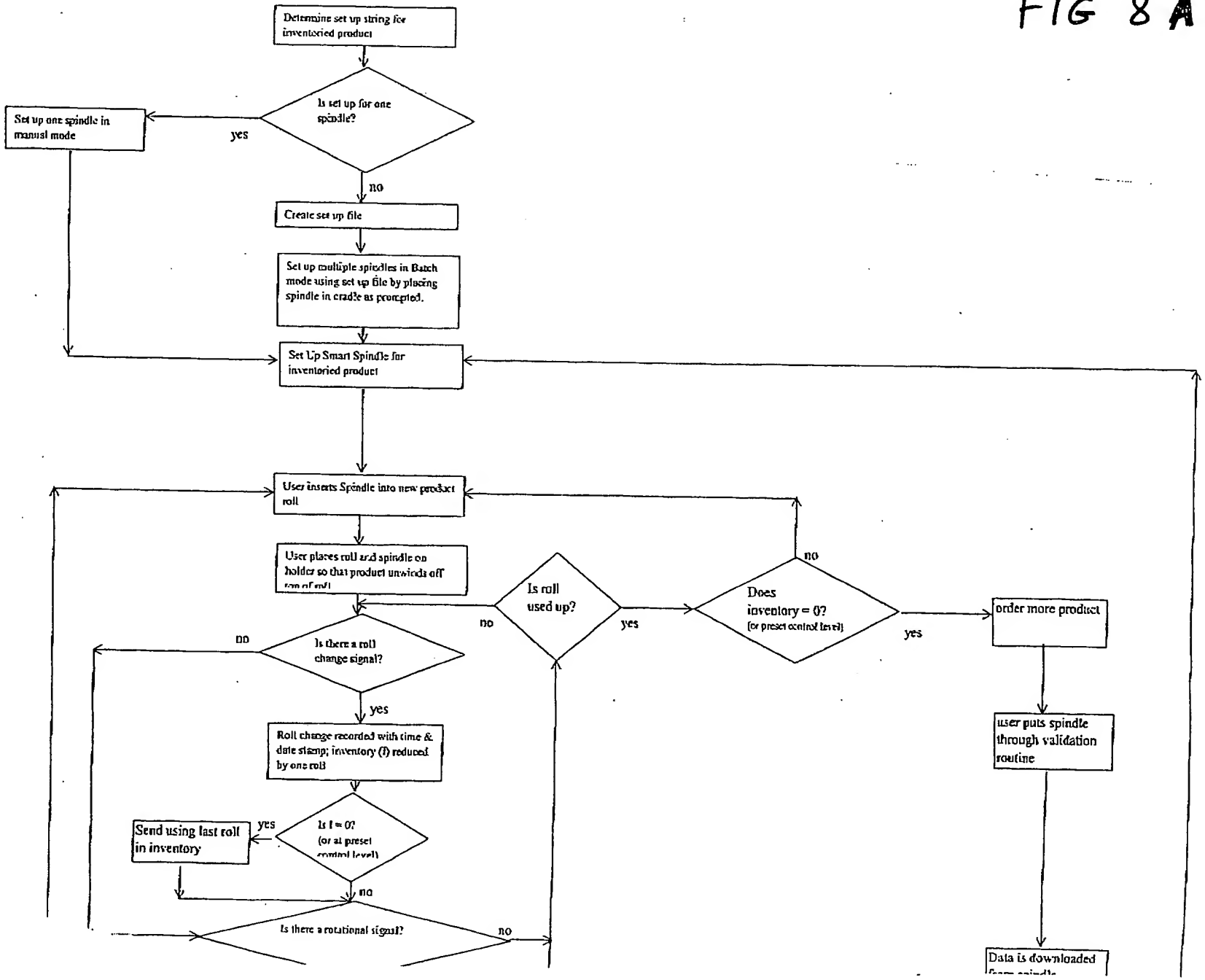

change signal?
yes
Roll change recorded with time & date stamp
Is there a rotational signal?
no
yes
Determine direction of signal, add signal to appropriate directional register: P or p
has > 2 seconds elapsed since last signal?
no
yes
Is there more than one signal?
no
Clear directional registers
yes
record number of signals as the absolute value |P-p|
record time and date of signal collection
is P>p?
no
Is p>P
no
yes
yes
Record direction as P
Record direction as p
spindle is put through validation routine
Data is downloaded from spindle
Does validation data match validation routine?
no
Discard data and place spindle into diagnostic routine.
yes
Save spindle data as a spindle file name as SSSSSSSS-NNNNN-R-CCC

FIG 7B

Use of Smart Spindle to control an inventory in Consumer Home, factory, retail store

FIG 8A



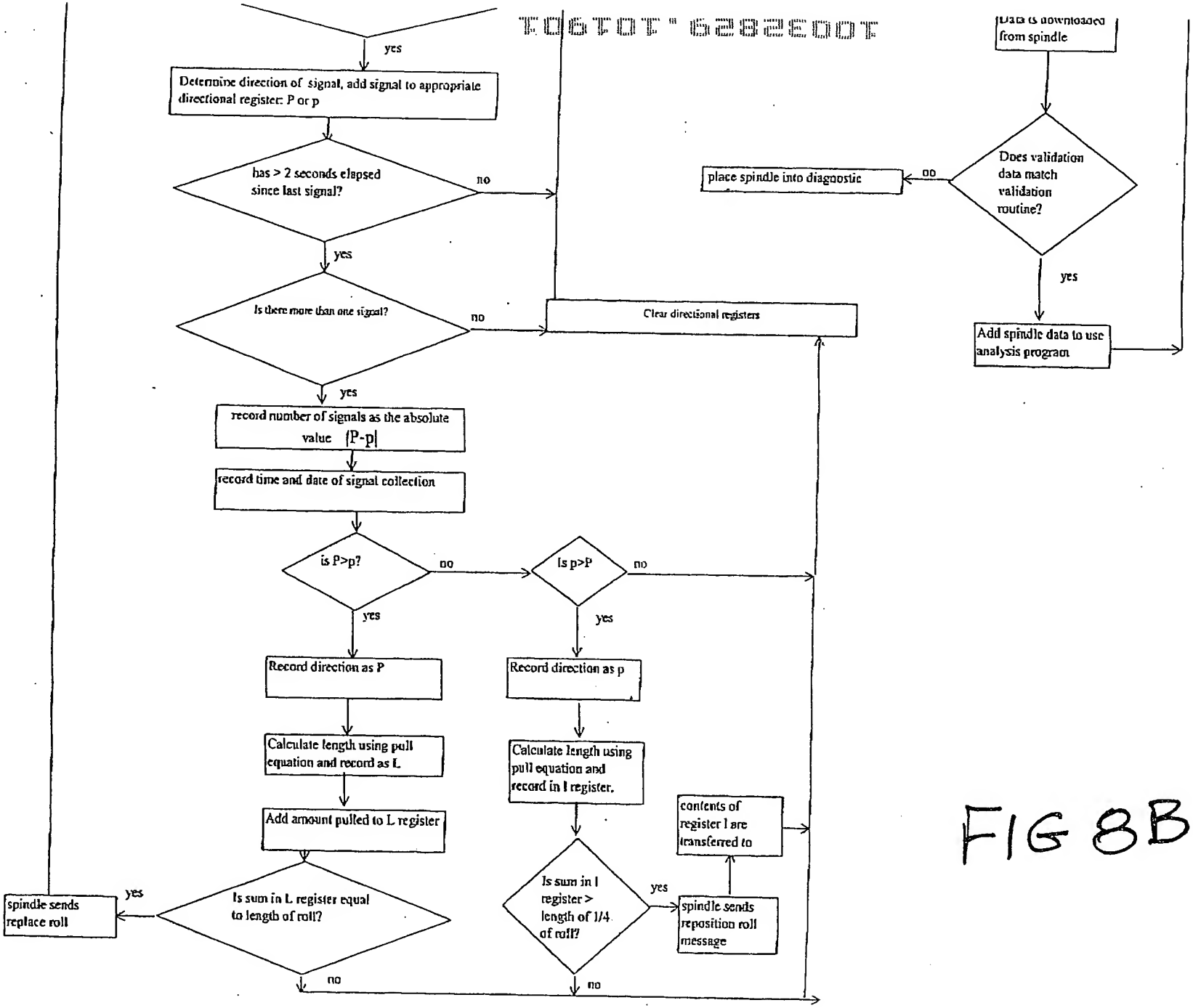

yes
Determine direction of signal, add signal to appropriate directional register: P or p
has > 2 seconds elapsed since last signal?
no
yes
Is there more than one signal?
no
Clear directional registers
yes
record number of signals as the absolute value |P-p|
record time and date of signal collection
is P>p?
no
Is p>P
no
yes
yes
Record direction as P
Record direction as p
Calculate length using pull equation and record as L
Calculate length using pull equation and record in l register.
Add amount pulled to L register
contents of register l are transferred to
Is sum in L register equal to length of roll?
yes
spindle sends replace roll
Is sum in l register > length of 1/4 of roll?
yes
spindle sends reposition roll message
no
no
Data is downloaded from spindle
Does validation data match validation routine?
no
place spindle into diagnostic
yes
Add spindle data to use analysis program

FIG 8B

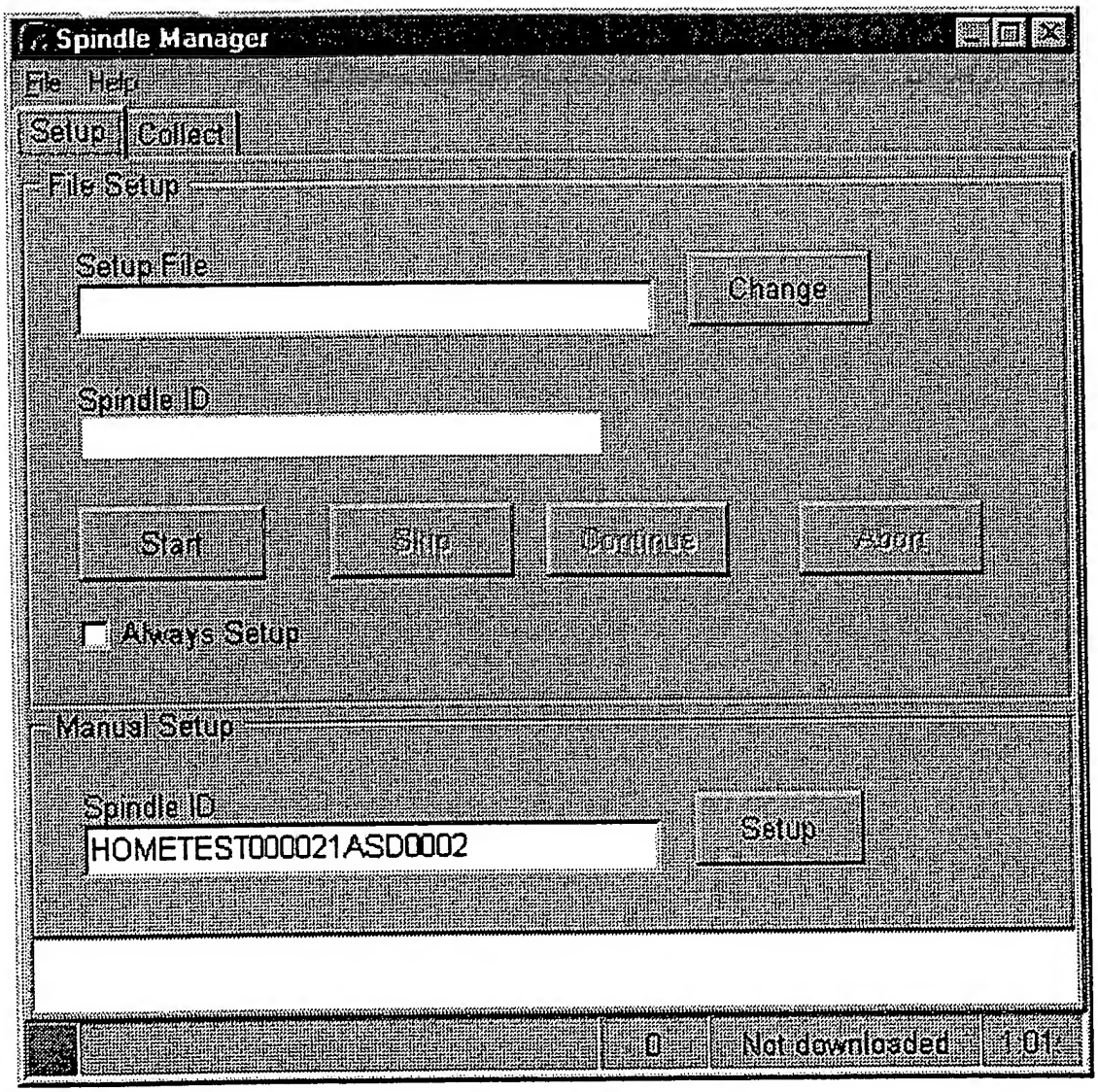
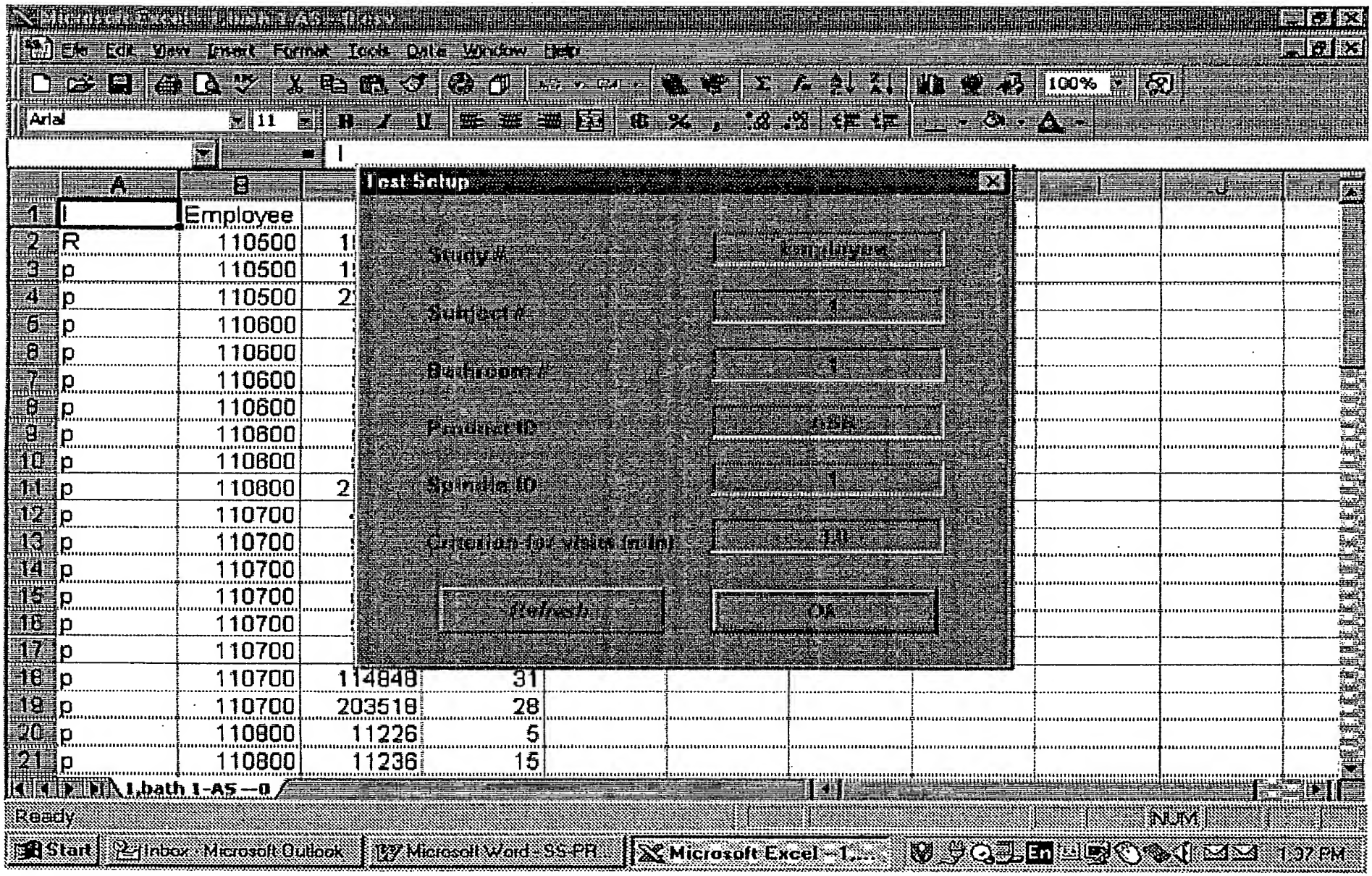

Spindle Manager
File Help
Setup
Collect
File Setup
Setup File
Change
Spindle ID
Start
Stop
Continue
Abort
Always Setup
Manual Setup
Spindle ID
HOMETEST000021ASD0002
Setup
0
Not downloaded
1.01

Fig. 9

Fig. 8B


Test Setup
Study #:
Subject #:
Bedroom #:
Product ID:
Spindle ID:
Criterion for visits (min):
Refresh
OK
Employee
1.bath 1-AS -- 0
Ready
Start
Inbox - Microsoft Outlook
Microsoft Word - SS-PR...
Microsoft Excel - 1...
1:07 PM

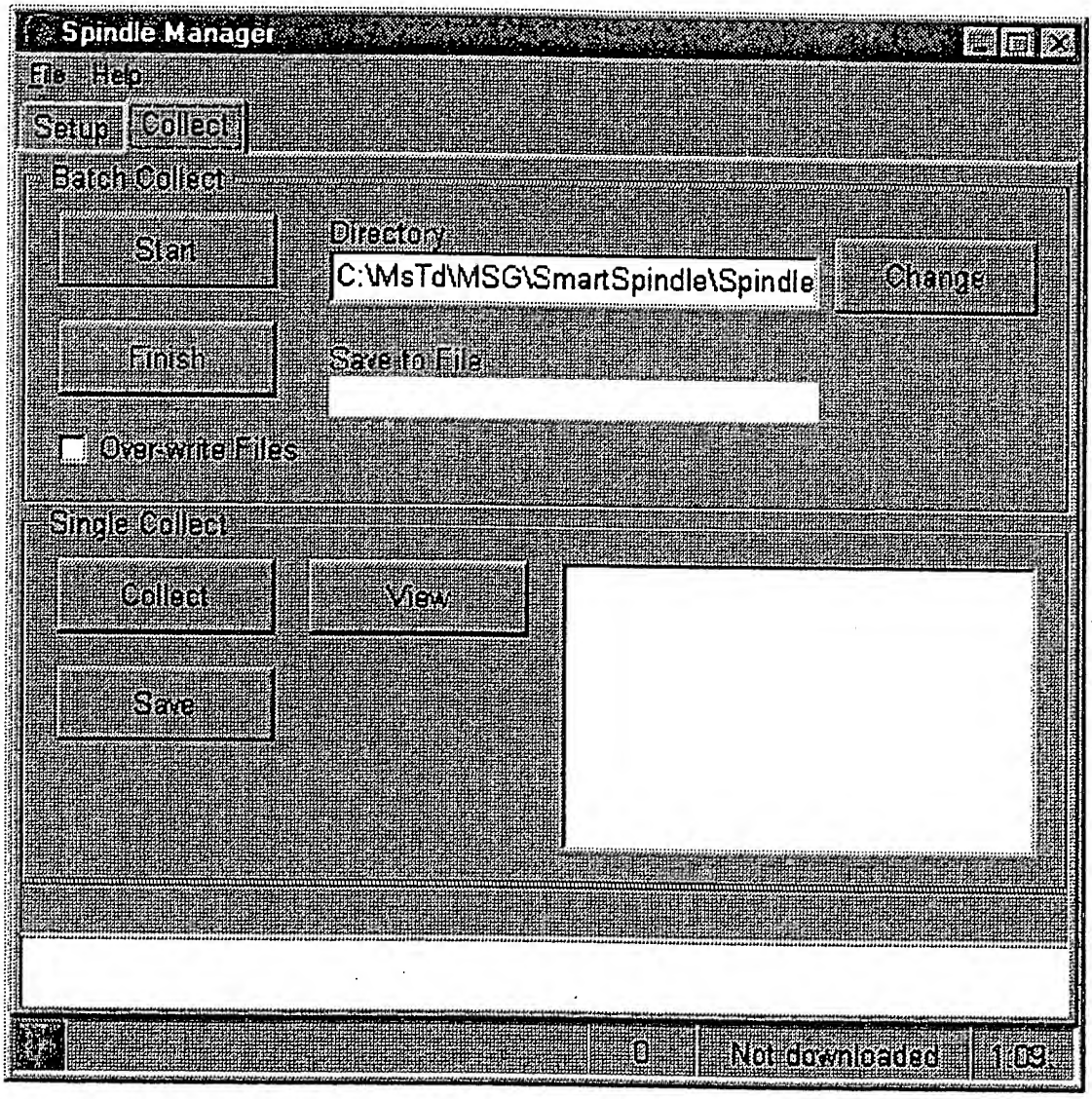

Spindle Manager
File Help
Setup
Collect
Batch Collect
Start
Directory
C:\MsTd\MSG\SmartSpindle\Spindle
Change
Finish
Save to File
Over-write Files
Single Collect
Collect
View
Save
0
Not downloaded
1 09

Fig. 11

Fig. 12

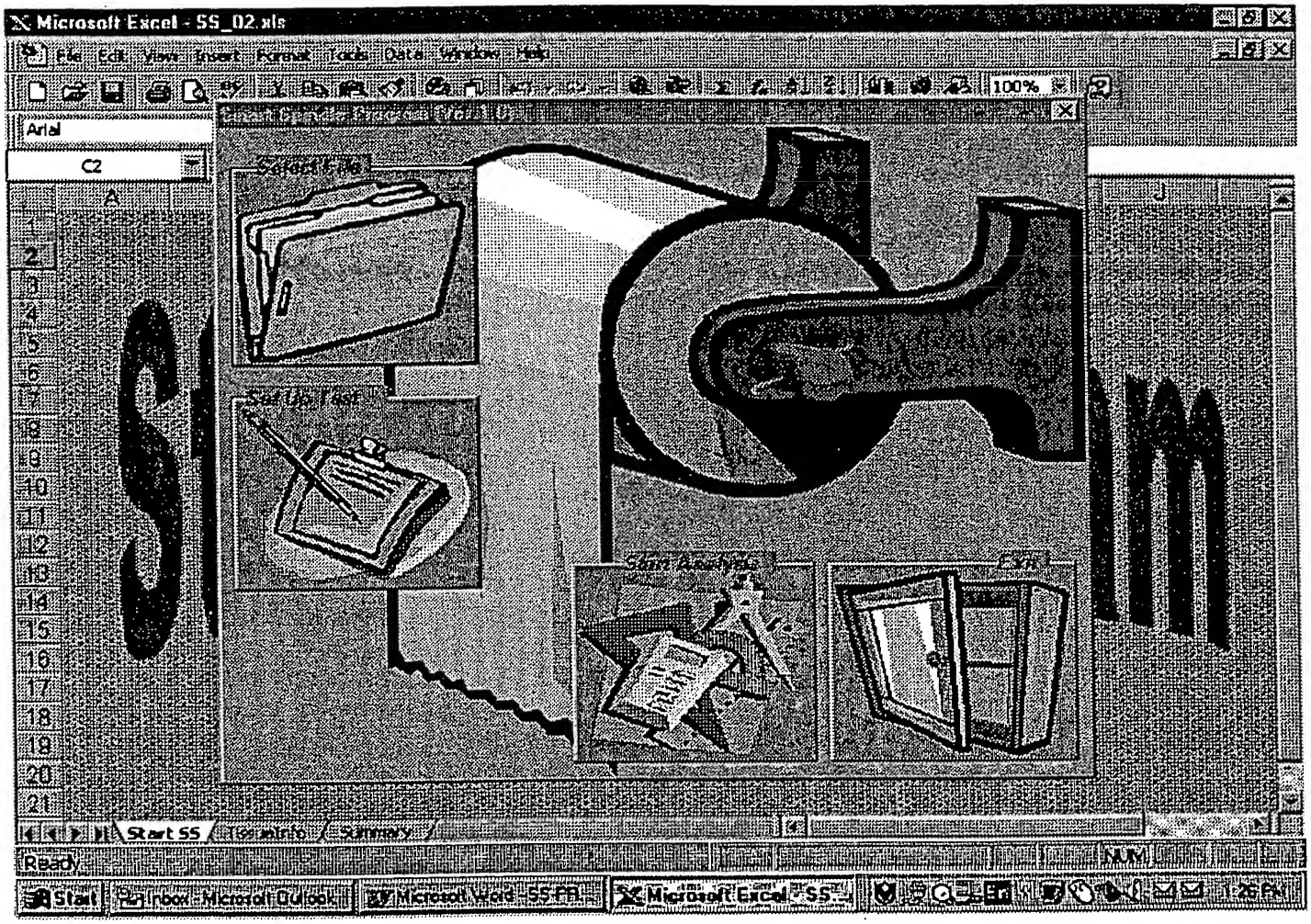


Fig. 13